

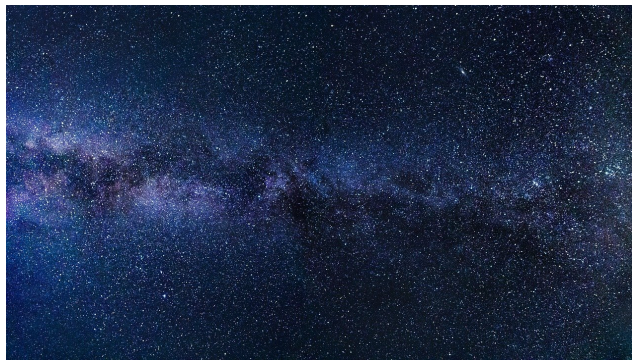
## 1: Introduction

### Learning Objectives

- The basics of science and the scientific method
- Understanding our place in the universe.
- Able to locate major constellations and stars using the celestial sphere coordinate system of declination and right ascension
- Describe how the motion of the Earth affects the day/night cycle and the passage of the season.
- Understand how the motion of the Moon results in solar and lunar eclipses and the phases of the Moon.
- Using triangulation and parallax to measure the distance to far away objects.

Look up into the sky during a clear night and what do you see? You will see the Moon, most nights, and more stars than you can count. If you know where to look, you might even see a few of the planets that are visible from Earth. If you are lucky, maybe you will catch the glimpse of a meteor or “shooting star.” Certain times of the year, you may even see a whole meteor shower. Certain rare times, you might catch a lunar eclipse or even a comet.

Ever since the earliest humans looked up at the night sky, people have been fascinated by the lights above. They asked themselves, what are they? Where did they come from? How far away are they? As they looked at the sky night after night, they noticed certain patterns. Most stars appeared to rise and fall, much like the Sun and the Moon, but others appeared to rotate around a certain point in north (if they lived in the northern hemisphere) or the south (if they lived in the southern hemisphere). Regardless, most of the stars tended to move as a unit, staying together in groups that they named “**constellations**” (Greek for “stars together”). Some constellations only rose and fell during certain seasons throughout the year while those that rotated around the north or south appeared every night. A small number of stars, five to be precise, seemed to move of their own accord. Sometimes they would be in one constellation, sometimes in another. Sometimes they rose after sunset and while other times, they rose before sunrise. The ancient people called this apparently rootless stars “wanderers” or “**planets**” to distinguish them for the fixed stars that obeyed certain patterns.



The Milky Way Galaxy as seen on a clear night on Earth.

<https://wallpaperaccess.com/4k-star>

Of course, now we know that these planets are not stars at all. They are bodies that, like the Earth, orbit our Sun in regular, elliptical orbits. There are eight official planets in our Solar System along with a myriad of other bodies including moons, asteroids, comets, and **dwarf planets**. Four of the planets, including our Earth, are **terrestrial planets**, small, dense rocky bodies that orbit close to the Sun. The other four are **Jovian planets**, gaseous or icy giants that orbit beyond the main asteroid belt. Dwarf planets, a category created when Pluto was demoted from planetary status, are intermediate bodies. Too big to be asteroids and too small to be planets and having failed to clear out their orbital paths with similar bodies, dwarf planets occupy that middle niche.

But why did the ancient people take such an interest in the night sky? The answer lies with those patterns they noticed. The sky became both their calendar and their navigation chart. By noting which stars always appeared in certain locations at the same time every year, they could predict the coming of spring, letting people know when the river was about to flood its banks and deposit fresh nutrients or simply when it was the best time to plant their crops. Before the invention of the compass, the night sky was their own way to determine which direction was north, a crucial piece of knowledge to getting lost while traveling. Because the stars could tell people such useful information, people found that it made sense that they tell them other things as well. After, if the stars can us when to plant and harvest crops, why not assume it could tell you when it was a good time to get married or invade your

neighbors. People searched the sky for any telltale signs they could use to divine the future. They saw comets as heralds of doom and new stars were signs of an important birth.

Of course, today scientists do not look at the sky for portents of the future. They look at the sky to study the various bodies we see. This chapter will begin with a basics of the scientific method and then discuss the methods used by astronomers used to located objects in the sky. Then we will finish up with a discussion how the motions of the Earth and the Moon relate to our measurements of time and the phenomena of lunar and solar eclipses.

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